

SEQUENCE LISTING

<110> AKZO Nobel N.V.

<120> *Lawsonia intracellularis* subunit vaccines.

<130> 2004.001

<160> 18

<170> PatentIn version 3.2

<210> 1

<211> 2088

<212> DNA

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<220>

<221> CDS

<222> (16)..(2085)

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Gly Leu Leu Ser His Gly Glu Lys Met Asn Val Ile Gly Asn Asn Ile
      15              20              25

gct aac gta aat aca gta ggc ttt aaa ggc caa cgt atg gat ttc gca     147
Ala Asn Val Asn Thr Val Gly Phe Lys Gly Gln Arg Met Asp Phe Ala
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gac ttt att tat caa gat ggc ttt agt act gca ggg att aca caa att     195
Asp Phe Ile Tyr Gln Asp Gly Phe Ser Thr Ala Gly Ile Thr Gln Ile
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gga cgt ggt gta ggc att gga gct gtc atg ggg aac ttt ggt cag ggt     243
Gly Arg Gly Val Gly Ile Gly Ala Val Met Gly Asn Phe Gly Gln Gly
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agt ttt gaa acc aca act gaa gca aca gac ctt gct att ggt ggt cgt     291
Ser Phe Glu Thr Thr Thr Glu Ala Thr Asp Leu Ala Ile Gly Gly Arg
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gga ttt ttc aaa gtt aaa cca caa gga tca gag act tca tat tat acc     339
Gly Phe Phe Lys Val Lys Pro Gln Gly Ser Glu Thr Ser Tyr Tyr Thr
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Arg Ala Gly Asn Phe Arg Phe Asn Asn Asp Gly Tyr Leu Val Asp Pro
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cat gga tat gct ctt cag ggt tgg aaa att gat aat act gaa ggg cca     435
His Gly Tyr Ala Leu Gln Gly Trp Lys Ile Asp Asn Thr Glu Gly Pro
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caa cgt atc tca ggt ggt gtt aat cca ggt aca aat act tcg cag att     483
Gln Arg Ile Ser Gly Gly Val Asn Pro Gly Thr Asn Thr Ser Gln Ile
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Ala Pro Leu Gln Thr Thr Asn Val Ser Phe Asn Val Asn Leu Ser Ser	
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gat aaa tct gga gat aaa tct caa aac gtt aat agt cca ttt acc tca	627
Asp Lys Ser Gly Asp Lys Ser Gln Asn Val Asn Ser Pro Phe Thr Ser	
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tta ttt aat ata tgg aat ggt aaa caa cca agt gaa cct aac aat cca	675
Leu Phe Asn Ile Trp Asn Gly Lys Gln Pro Ser Glu Pro Asn Asn Pro	
205 210 215 220	
cct atg cct gaa agt gca tat agt tat cag aca tct att aag gta tat	723
Pro Met Pro Glu Ser Ala Tyr Ser Tyr Gln Thr Ser Ile Lys Val Tyr	
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Asp Glu Ala Gly Gly Thr His Thr Leu Thr Val Tyr Phe Asp Gln Val	
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Ser Pro Lys Asp Tyr Lys Gly Gly Ser Gly Glu Ser Val Trp Glu	
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Tyr Val Val Thr Met Asp Pro Ser Glu Asp Asn Arg Gln Val Ser Val	
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Gly Gly Asn Ile Val Asp Ile Lys Asp Thr Lys Ala Ala Gly Met Leu	
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Thr Gly Ala Leu Ile Asn Gly Asn Gly Phe Thr Ile Asp Arg Asp Gly	
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Gln Ser Asn Ser Lys Ile Val Thr Thr Ile Asp Gln Met Leu Glu Thr
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 685 690

2088

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 35 40 45

Gln Asp Gly Phe Ser Thr Ala Gly Ile Thr Gln Ile Gly Arg Gly Val
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Gly Ile Gly Ala Val Met Gly Asn Phe Gly Gln Gly Ser Phe Glu Thr
 65 70 75 80

Thr Thr Glu Ala Thr Asp Leu Ala Ile Gly Gly Arg Gly Phe Phe Lys
 85 90 95

Val Lys Pro Gln Gly Ser Glu Thr Ser Tyr Tyr Thr Arg Ala Gly Asn
 100 105 110

Phe Arg Phe Asn Asn Asp Gly Tyr Leu Val Asp Pro His Gly Tyr Ala
 115 120 125

Leu Gln Gly Trp Lys Ile Asp Asn Thr Glu Gly Pro Gln Arg Ile Ser
 130 135 140

Gly Gly Val Asn Pro Gly Thr Asn Thr Ser Gln Ile Met Gly Thr Gly
 145 150 155 160

Glu Pro Thr Asp Ile Arg Leu Asp Thr Trp Thr Val Ala Pro Leu Gln
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Thr Thr Asn Val Ser Phe Asn Val Asn Leu Ser Ser Asp Lys Ser Gly
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Asp Lys Ser Gln Asn Val Asn Ser Pro Phe Thr Ser Leu Phe Asn Ile
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Trp Asn Gly Lys Gln Pro Ser Glu Pro Asn Asn Pro Pro Met Pro Glu
 210 215 220

Ser Ala Tyr Ser Tyr Gln Thr Ser Ile Lys Val Tyr Asp Glu Ala Gly
 225 230 235 240

Gly Thr His Thr Leu Thr Val Tyr Phe Asp Gln Val Ser Pro Lys Asp
 245 250 255

Tyr Lys Gly Gly Gly Ser Gly Glu Ser Val Trp Glu Tyr Val Val Thr
 260 265 270

Met Asp Pro Ser Glu Asp Asn Arg Gln Val Ser Val Gly Gly Asn Ile
 275 280 285

Val Asp Ile Lys Asp Thr Lys Ala Ala Gly Met Leu Met Ser Gly Thr
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Leu Ser Phe Asp Ser Ser Gly Lys Leu Ala Asn Gln Ser Ala Tyr Ser
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Leu Asn Gly Ser Arg Lys Pro Ala Val Asp Pro Ala Thr Gly Ala Leu
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Ile Asn Gly Asn Gly Phe Thr Ile Asp Arg Asp Gly Asn Ala Ile Pro
 340 345 350

Ile Leu Asn Ile Asp Asn Pro Ala Glu Asn Phe Tyr Pro Ala Glu Val
 355 360 365

Ser Asn Asn Gly Phe Pro Met Ile Val Ala Asn Phe Thr Gly Val Pro
 370 375 380

Gly Lys Asn Thr Ala Gly Ser Val Gly Asp Ala Thr Thr Phe Phe Thr
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Glu Ile Asp Phe Gly Leu Lys Ala Thr Asp Leu Asp Asn Thr Trp Lys
 405 410 415

Asn Ala Asn Glu Pro Leu Ser Ser Leu Ser Tyr Lys Lys Thr His Asn
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Pro Met Asp Val Ala Gly Gly Trp Thr Val Gly Gly Tyr Lys Thr Pro
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Ala Pro Ser Val Thr Glu Leu Gly Met Ala Gln Ile Leu Glu Asn Pro
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Ala Gly Val Met Pro Gln Tyr Tyr Phe Gly Asn Pro Asn Tyr Asp Asn
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Thr Val Pro Gln Ser Pro Pro Tyr Val Tyr Lys Asn Glu Ala Ser Tyr
485 490 495

Gln Ala Ala Tyr Lys Thr Ala Leu Thr Ala Ala Gly Gly Thr Ala Ala
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Asp Ile Lys Lys Glu His Trp Pro His Asn Ala Ala Ser Gly Ile Leu
515 520 525

Glu Ala Asn Asp Pro Pro Asn Val Lys Asp Leu Ala Asn Met Asn Gly
530 535 540

Thr Pro Asn Arg Leu Ser Asn Ala Phe Thr Asn Tyr Ala Gly Gly Ser
545 550 555 560

Ser Thr Lys Ser Ala Ser Gln Asn Gly Tyr Gly Phe Gly Asp Leu Met
565 570 575

Asn Tyr Ser Val Asn Ala Glu Gly Val Leu Phe Gly Val Tyr Ser Asn
580 585 590

Gly Val Gln Leu Pro Leu Tyr Gln Val Ala Leu Tyr Asp Phe Asn Ser
595 600 605

Lys Gln Gly Leu Arg Arg Glu Gly Gly Asn Leu Phe Ser Gln Thr Arg
610 615 620

Glu Ser Gly Asp Pro Ser Ser Gly Ala Ala Asn Thr Ser Gly Phe Gly
625 630 635 640

Ser Ile Asn Ala Asn Thr Leu Glu Gly Ser Asn Val Asp Ile Ser Thr
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Glu Phe Val Ser Met Ile Ala Thr Gln Arg Gly Phe Gln Ser Asn Ser
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Phe Thr Val Gly Ile Ile Met Leu Ile Leu Ala Cys Leu Ala Ala Leu
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gag ttc ata caa gat ttt ccc aat agc tat caa gaa gat gga caa atg      148
Glu Phe Ile Gln Asp Phe Pro Asn Ser Tyr Gln Glu Asp Gly Gln Met
          25           30           35

gtt aca gga att att tca aaa ata ata ggc tct aac tgt gat aat tct      196
Val Thr Gly Ile Ile Ser Lys Ile Ile Gly Ser Asn Cys Asp Asn Ser
          40           45           50           55

tca aca tct gat ata aat aat aag aaa tcc ata gat aga gat aaa gat      244
Ser Thr Ser Asp Ile Asn Asn Lys Lys Ser Ile Asp Arg Asp Lys Asp
          60           65           70

aca tta ctc tca agt agt aat aga aat aca ata caa gcc ggt act cca      292
Thr Leu Leu Ser Ser Ser Asn Arg Asn Thr Ile Gln Ala Gly Thr Pro
          75           80           85

cat caa gaa aat aac ata aaa gaa gat ctt caa ctg act aac aaa aat      340
His Gln Glu Asn Asn Ile Lys Glu Asp Leu Gln Leu Thr Asn Lys Asn
          90           95           100

gaa caa aca act cca gaa gaa gaa gaa gaa agt aaa ttt att tgg tta      388
Glu Gln Thr Thr Pro Glu Glu Glu Glu Glu Ser Lys Phe Ile Trp Leu
          105           110           115

aca gaa gct cca tca gag ctt aaa aaa gga gaa aaa gct ata aca caa      436
Thr Glu Ala Pro Ser Glu Leu Lys Lys Gly Glu Lys Ala Ile Thr Gln
          120           125           130           135

aca aga ttg tct att ggt aag gat ata tct ttt aga att act gct gat      484
Thr Arg Leu Ser Ile Gly Lys Asp Ile Ser Phe Arg Ile Thr Ala Asp
          140           145           150

gat gcc atc aaa gct caa tca atg atg tta aaa aat cca gat agg ttt      532
Asp Ala Ile Lys Ala Gln Ser Met Met Leu Lys Asn Pro Asp Arg Phe
          155           160           165

gtt tta gat ctt caa gga aag tgg ggt att tcc ctt cca cct att cca      580
Val Leu Asp Leu Gln Gly Lys Trp Gly Ile Ser Leu Pro Pro Ile Pro
          170           175           180

cct aca aat cct tgg tta aaa aaa ata cgc tta ggt act aat aat gga      628
Pro Thr Asn Pro Trp Leu Lys Lys Ile Arg Leu Gly Thr Asn Asn Gly
          185           190           195

aat aca cga ctt gtc ttt gat ctt caa aaa aaa cca tct aaa act gaa      676
Asn Thr Arg Leu Val Phe Asp Leu Gln Lys Lys Pro Ser Lys Thr Glu
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att aaa caa tta gat aca aat aaa att gaa atc caa att cattaaattg      725
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 Tyr Gln Glu Asp Gly Gln Met Val Thr Gly Ile Ile Ser Lys Ile Ile
 35 40 45

 Gly Ser Asn Cys Asp Asn Ser Ser Thr Ser Asp Ile Asn Asn Lys Lys
 50 55 60

 Ser Ile Asp Arg Asp Lys Asp Thr Leu Leu Ser Ser Ser Asn Arg Asn
 65 70 75 80

 Thr Ile Gln Ala Gly Thr Pro His Gln Glu Asn Asn Ile Lys Glu Asp
 85 90 95

 Leu Gln Leu Thr Asn Lys Asn Glu Gln Thr Thr Pro Glu Glu Glu Glu
 100 105 110

 Glu Ser Lys Phe Ile Trp Leu Thr Glu Ala Pro Ser Glu Leu Lys Lys
 115 120 125

 Gly Glu Lys Ala Ile Thr Gln Thr Arg Leu Ser Ile Gly Lys Asp Ile
 130 135 140

 Ser Phe Arg Ile Thr Ala Asp Asp Ala Ile Lys Ala Gln Ser Met Met
 145 150 155 160

 Leu Lys Asn Pro Asp Arg Phe Val Leu Asp Leu Gln Gly Lys Trp Gly
 165 170 175

 Ile Ser Leu Pro Pro Ile Pro Pro Thr Asn Pro Trp Leu Lys Lys Ile
 180 185 190

 Arg Leu Gly Thr Asn Asn Gly Asn Thr Arg Leu Val Phe Asp Leu Gln
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 Lys Lys Pro Ser Lys Thr Glu Ile Lys Gln Leu Asp Thr Asn Lys Ile


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Glu Ile Gln Ile
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Val Ala Leu Cys Ile Met Phe Ile Ile Met Val Gln Val Leu Gln Ala
      10           15           20

aat gca gct agc tat gtg gtt ttg cca ttt aaa gta aat gct cct cca      150
Asn Ala Ala Ser Tyr Val Val Leu Pro Phe Lys Val Asn Ala Pro Pro
      25           30           35

agc tat act tat ttg gaa aaa gct atc cca tct atg tta act tct aga      198
Ser Tyr Thr Tyr Leu Glu Lys Ala Ile Pro Ser Met Leu Thr Ser Arg
      40           45           50           55

ctt tat tgg gaa gaa cgt ttt caa cct atc ccg gat gct aat gct att      246
Leu Tyr Trp Glu Glu Arg Phe Gln Pro Ile Pro Asp Ala Asn Ala Ile
      60           65           70

aaa gca gga aag gta gaa gat ata aag gaa atg gat aag gca agg ata      294
Lys Ala Gly Lys Val Glu Asp Ile Lys Glu Met Asp Lys Ala Arg Ile
      75           80           85

gct aca ggt gca gac tat ctt ata tgg gga cag gta aat att gta ggt      342
Ala Thr Gly Ala Asp Tyr Leu Ile Trp Gly Gln Val Asn Ile Val Gly
      90           95           100

gat gaa gct acg ctt gat gta caa gtt tgt gat ata gaa gga tca att      390
Asp Glu Ala Thr Leu Asp Val Gln Val Cys Asp Ile Glu Gly Ser Ile
      105          110          115

tgg agg aaa agt aaa aat aca aaa gtt gat aat tta att act gcc ctt      438
Trp Arg Lys Ser Lys Asn Thr Lys Val Asp Asn Leu Ile Thr Ala Leu
      120          125          130          135

caa gat aca gca gat gca att aat agt gag ttg ttt ggg cgt gca act      486
Gln Asp Thr Ala Asp Ala Ile Asn Ser Glu Leu Phe Gly Arg Ala Thr
      140          145          150

aca aaa cca tca tca aaa gct act att gta gct caa atg aac tct gga      534
Thr Lys Pro Ser Ser Lys Ala Thr Ile Val Ala Gln Met Asn Ser Gly
      155          160          165

ttg att aag gga aaa gga aat gaa aat cag tca tat ctt aat cca gaa      582
Leu Ile Lys Gly Lys Gly Asn Glu Asn Gln Ser Tyr Leu Asn Pro Glu
      170          175          180

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 Lys Phe Phe Glu Asn Tyr Arg Ser Phe Ala Glu Gly Glu Ile Gln Ala
 460 465 470

tta aca tgg gac ggc tta gga tta ggt ctt gta tgg aat aca cgt cgt 1494
 Leu Thr Trp Asp Gly Leu Gly Leu Gly Leu Val Trp Asn Thr Arg Arg
 475 480 485

att aag gga act att aca gat ttt gcc tta gct gat atg aat aat gat 1542
 Ile Lys Gly Thr Ile Thr Asp Phe Ala Leu Ala Asp Met Asn Asn Asp
 490 495 500

ggg aag tta gac tta gtt gtt tcc gtt aat agc cat aca ggg att ctt 1590
 Gly Lys Leu Asp Leu Val Val Ser Val Asn Ser His Thr Gly Ile Leu
 505 510 515

gga cta gaa aaa cga aag aca att ata gta ttt tat cct tta gag gta 1638
 Gly Leu Glu Lys Arg Lys Thr Ile Ile Val Phe Tyr Pro Leu Glu Val
 520 525 530 535

gat aaa caa ggt atc cct aag gct gtt gaa gat aac taa ttttttccta 1687
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 35 40 45

Pro Ser Met Leu Thr Ser Arg Leu Tyr Trp Glu Glu Arg Phe Gln Pro
 50 55 60

Ile Pro Asp Ala Asn Ala Ile Lys Ala Gly Lys Val Glu Asp Ile Lys
 65 70 75 80

Glu Met Asp Lys Ala Arg Ile Ala Thr Gly Ala Asp Tyr Leu Ile Trp
 85 90 95

Gly Gln Val Asn Ile Val Gly Asp Glu Ala Thr Leu Asp Val Gln Val
 100 105 110

Cys Asp Ile Glu Gly Ser Ile Trp Arg Lys Ser Lys Asn Thr Lys Val
 115 120 125

Asp Asn Leu Ile Thr Ala Leu Gln Asp Thr Ala Asp Ala Ile Asn Ser
 130 135 140

Glu Leu Phe Gly Arg Ala Thr Thr Lys Pro Ser Ser Lys Ala Thr Ile
 145 150 155 160

Val Ala Gln Met Asn Ser Gly Leu Ile Lys Gly Lys Gly Asn Glu Asn
 165 170 175

Gln Ser Tyr Leu Asn Pro Glu Phe Arg Tyr Gln Gly Ser Asn Leu Ser
 180 185 190

Arg Gly Arg Ser Gln Ala Leu Pro Phe Ala Ser Val Gly Ile Val Val
 195 200 205

Gly Asp Phe Ile Gly Asp Asn Lys Asn Glu Val Ala Ile Leu Ser Glu
 210 215 220

Tyr Lys Val His Ile Tyr Arg Trp Glu Glu Glu Arg Leu Ala Leu Leu
 225 230 235 240

Gly Glu Tyr Lys Phe Pro Arg Ser Leu Gln Ser Leu His Ile Arg Ala
 245 250 255

Phe Asp Val Asp His Asp Gly Val Gln Glu Ile Ile Val Ser Cys Phe
 260 265 270

Asp Pro Ser Tyr Ala Lys Pro Tyr Ser Phe Ile Leu Ser Phe Lys Asn
 275 280 285

Arg Val Phe Lys Glu Leu Ala Thr Asn Leu Pro Phe Tyr Leu Asn Val
 290 295 300

Val Lys Leu Pro Pro Asp Phe Ser Pro Met Leu Ile Gly Gln Lys Ser
 305 310 315 320

Asp Asn Ser Arg Ile Phe Ser Pro Ser Gly Val Tyr Glu Ile Glu Lys
 325 330 335

His Gly Arg Asn Tyr Ile Met Gly Asn Arg Leu Ser Leu Pro Lys Glu
 340 345 350

Ala Asn Ile Phe Asn Phe Ser Trp Leu Pro Ser Asp Ser Leu Lys Asp
 355 360 365

Glu Glu Ala Lys Leu Val Leu Val Thr Asn Asn Glu Arg Leu Val Val
 370 375 380

Tyr Asn Thr Lys Gly Thr Arg Leu Phe Met Thr Glu Glu Val Tyr Tyr
 385 390 395 400

Gly Ser Ser Val Gly Ile Asp Glu Pro Ser Asn Met Pro Gly Leu Gly
 405 410 415

Lys Ser Lys Glu Leu Ile Pro Ser Lys Tyr Phe Ile Pro Gly Arg Met
 420 425 430

Ile Pro Ile Asn Leu Asp Ser Met Gly Lys Trp Glu Leu Leu Val Ser
 435 440 445

Lys Pro Ile Ser Val Ala Ala Lys Phe Phe Glu Asn Tyr Arg Ser Phe
 450 455 460

Ala Glu Gly Glu Ile Gln Ala Leu Thr Trp Asp Gly Leu Gly Leu Gly
 465 470 475 480

Leu Val Trp Asn Thr Arg Arg Ile Lys Gly Thr Ile Thr Asp Phe Ala
 485 490 495

Leu Ala Asp Met Asn Asn Asp Gly Lys Leu Asp Leu Val Val Ser Val
 500 505 510

Asn Ser His Thr Gly Ile Leu Gly Leu Glu Lys Arg Lys Thr Ile Ile
 515 520 525

Val Phe Tyr Pro Leu Glu Val Asp Lys Gln Gly Ile Pro Lys Ala Val
 530 535 540

Glu Asp Asn
 545

<210> 7
 <211> 1564
 <212> DNA
 <213> Lawsonia intracellularis

<220>
 <221> CDS
 <222> (41)..(1522)

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 Met Val Ser Tyr Ile
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cgt tta tta gga agt ata ttt tta gta tta gca att ttt ggt tgt ggc 103
 Arg Leu Leu Gly Ser Ile Phe Leu Val Leu Ala Ile Phe Gly Cys Gly

	10	15	20	
	gct cag ttt aat aaa ccc tct tta ctt gat gaa acc cct ata gat tac			151
	Ala Gln Phe Asn Lys Pro Ser Leu Leu Asp Glu Thr Pro Ile Asp Tyr			
	25	30	35	
	agt tct gta ctt tct gat tac ata gta gaa tta gaa aaa gaa cca ctt			199
	Ser Ser Val Leu Ser Asp Tyr Ile Val Glu Leu Glu Lys Glu Pro Leu			
	40	45	50	
	cag tat ata tta cta aaa aaa gaa aaa ttt tct caa atg gag ata tat			247
	Gln Tyr Ile Leu Leu Lys Lys Glu Lys Phe Ser Gln Met Glu Ile Tyr			
	55	60	65	
	aat tat caa ttc aca tca caa cat tgg tct cca gat aat ttt gta tca			295
	Asn Tyr Gln Phe Thr Ser Gln His Trp Ser Pro Asp Asn Phe Val Ser			
	70	75	80	85
	cct gct ata tgg gaa cat cag gta gat ata tat atc cct cac cat cca			343
	Pro Ala Ile Trp Glu His Gln Val Asp Ile Tyr Ile Pro His His Pro			
	90	95	100	
	gtt tca gaa cgt gca ctt ctt atc atc aat aat ggt att aat aat ggt			391
	Val Ser Glu Arg Ala Leu Leu Ile Ile Asn Asn Gly Ile Asn Asn Gly			
	105	110	115	
	aca ttt ttt act tct cct aaa gct cca act gat ttt act cca gaa gta			439
	Thr Phe Phe Thr Ser Pro Lys Ala Pro Thr Asp Phe Thr Pro Glu Val			
	120	125	130	
	tta gaa gaa atc gct cgt tca aca aaa act gta gtc att gct cta agt			487
	Leu Glu Glu Ile Ala Arg Ser Thr Lys Thr Val Val Ile Ala Leu Ser			
	135	140	145	
	gat atc cca aat cag tat ctt act tat aga ggt gac tgg aga ttt ctt			535
	Asp Ile Pro Asn Gln Tyr Leu Thr Tyr Arg Gly Asp Trp Arg Phe Leu			
	150	155	160	165
	aag gaa gat gaa agt att gct atg agt tgg tct agt ttt tta caa gat			583
	Lys Glu Asp Glu Ser Ile Ala Met Ser Trp Ser Ser Phe Leu Gln Asp			
	170	175	180	
	cca gaa agt cgg tac aca aga cct ctc tat gtc cct atg gtt gca gca			631
	Pro Glu Ser Arg Tyr Thr Arg Pro Leu Tyr Val Pro Met Val Ala Ala			
	185	190	195	
	gtt tct cag gca atg act ctt gca gaa aag gag tta caa gca tta aaa			679
	Val Ser Gln Ala Met Thr Leu Ala Glu Lys Glu Leu Gln Ala Leu Lys			
	200	205	210	
	att aag cat ttt att gta tct ggt gtg tca aag cgt gga tgg aca aca			727
	Ile Lys His Phe Ile Val Ser Gly Val Ser Lys Arg Gly Trp Thr Thr			
	215	220	225	
	tgg ctt tca gct att gct gac tca cga gta gat gct att acc ccg ttt			775
	Trp Leu Ser Ala Ile Ala Asp Ser Arg Val Asp Ala Ile Thr Pro Phe			
	230	235	240	245
	gtt att gat gca ttg aat act cgg aaa gtc ctt gga cat atg tat aaa			823
	Val Ile Asp Ala Leu Asn Thr Arg Lys Val Leu Gly His Met Tyr Lys			
	250	255	260	
	aca tat gga aat aat tgg cct ata gca ttt tat cca tat tat aga ttt			871
	Thr Tyr Gly Asn Asn Trp Pro Ile Ala Phe Tyr Pro Tyr Tyr Arg Phe			
	265	270	275	

gat tta gat aaa caa cta gat aca gtt cct ttt ttc aat ctt atg aat Asp Leu Asp Lys Gln Leu Asp Thr Val Pro Phe Phe Asn Leu Met Asn 280 285 290	919
att gtt gat cca tat aga tat tta gga aca cca tat aag tct cga ctt Ile Val Asp Pro Tyr Arg Tyr Leu Gly Thr Pro Tyr Lys Ser Arg Leu 295 300 305	967
gct atc cct aaa tat att gta aat gca agt gga gat gat ttt tat gtc Ala Ile Pro Lys Tyr Ile Val Asn Ala Ser Gly Asp Asp Phe Tyr Val 310 315 320 325	1015
cct gat aat tca agt ttt tac tat gat gat ctc cct gga gag aaa gca Pro Asp Asn Ser Ser Phe Tyr Tyr Asp Asp Leu Pro Gly Glu Lys Ala 330 335 340	1063
tta cgt ttt gca cca aac tca aat cat cat ggg ata tta aat ttc aca Leu Arg Phe Ala Pro Asn Ser Asn His His Gly Ile Leu Asn Phe Thr 345 350 355	1111
aaa caa tcg ctt att cct ttt gtg aat aga gta caa aaa ggt att tca Lys Gln Ser Leu Ile Pro Phe Val Asn Arg Val Gln Lys Gly Ile Ser 360 365 370	1159
acg cca gtt tta gat att tcc aca gag atg acg gaa cga gtt caa tat Thr Pro Val Leu Asp Ile Ser Thr Glu Met Thr Glu Arg Val Gln Tyr 375 380 385	1207
gtg act gtt cgt ttt tct gaa gtt cca gag aag ata gta ctt tgg aaa Val Thr Val Arg Phe Ser Glu Val Pro Glu Lys Ile Val Leu Trp Lys 390 395 400 405	1255
gca gca aat cca gag tca cga gat ttt cgt tat gcc tgt cgt gtt agg Ala Ala Asn Pro Glu Ser Arg Asp Phe Arg Tyr Ala Cys Arg Val Arg 410 415 420	1303
tac atg gaa aca cca tta cac ctt tct gca aca ggg gaa gtt agc gtt Tyr Met Glu Thr Pro Leu His Leu Ser Ala Thr Gly Glu Val Ser Val 425 430 435	1351
tca tta gag atc cct tct gta gga tgg caa gct gct ttt att gaa gct Ser Leu Glu Ile Pro Ser Val Gly Trp Gln Ala Ala Phe Ile Glu Ala 440 445 450	1399
aca ttt aaa gat ggt ttt gtt gca aca aca cca gtg tat att tta cca Thr Phe Lys Asp Gly Phe Val Ala Thr Thr Pro Val Tyr Ile Leu Pro 455 460 465	1447
aaa gat ata tat cca cct ata aaa ata cca cct gta cat gga tta tta Lys Asp Ile Tyr Pro Pro Ile Lys Ile Pro Pro Val His Gly Leu Leu 470 475 480 485	1495
tgt aag ttt gta cat ggt cga acc tag taactagtag ttgttgtagt Cys Lys Phe Val His Gly Arg Thr 490	1542
gataatctaa aaggatatag at	1564
<210> 8	
<211> 493	
<212> PRT	
<213> Lawsonia intracellularis	

<400> 8

Met Val Ser Tyr Ile Arg Leu Leu Gly Ser Ile Phe Leu Val Leu Ala
 1 5 10 15

Ile Phe Gly Cys Gly Ala Gln Phe Asn Lys Pro Ser Leu Leu Asp Glu
 20 25 30

Thr Pro Ile Asp Tyr Ser Ser Val Leu Ser Asp Tyr Ile Val Glu Leu
 35 40 45

Glu Lys Glu Pro Leu Gln Tyr Ile Leu Leu Lys Lys Glu Lys Phe Ser
 50 55 60

Gln Met Glu Ile Tyr Asn Tyr Gln Phe Thr Ser Gln His Trp Ser Pro
 65 70 75 80

Asp Asn Phe Val Ser Pro Ala Ile Trp Glu His Gln Val Asp Ile Tyr
 85 90 95

Ile Pro His His Pro Val Ser Glu Arg Ala Leu Leu Ile Ile Asn Asn
 100 105 110

Gly Ile Asn Asn Gly Thr Phe Phe Thr Ser Pro Lys Ala Pro Thr Asp
 115 120 125

Phe Thr Pro Glu Val Leu Glu Glu Ile Ala Arg Ser Thr Lys Thr Val
 130 135 140

Val Ile Ala Leu Ser Asp Ile Pro Asn Gln Tyr Leu Thr Tyr Arg Gly
 145 150 155 160

Asp Trp Arg Phe Leu Lys Glu Asp Glu Ser Ile Ala Met Ser Trp Ser
 165 170 175

Ser Phe Leu Gln Asp Pro Glu Ser Arg Tyr Thr Arg Pro Leu Tyr Val
 180 185 190

Pro Met Val Ala Ala Val Ser Gln Ala Met Thr Leu Ala Glu Lys Glu
 195 200 205

Leu Gln Ala Leu Lys Ile Lys His Phe Ile Val Ser Gly Val Ser Lys
 210 215 220

Arg Gly Trp Thr Thr Trp Leu Ser Ala Ile Ala Asp Ser Arg Val Asp
 225 230 235 240

Ala Ile Thr Pro Phe Val Ile Asp Ala Leu Asn Thr Arg Lys Val Leu
 245 250 255

Gly His Met Tyr Lys Thr Tyr Gly Asn Asn Trp Pro Ile Ala Phe Tyr
 260 265 270
 Pro Tyr Tyr Arg Phe Asp Leu Asp Lys Gln Leu Asp Thr Val Pro Phe
 275 280 285
 Phe Asn Leu Met Asn Ile Val Asp Pro Tyr Arg Tyr Leu Gly Thr Pro
 290 295 300
 Tyr Lys Ser Arg Leu Ala Ile Pro Lys Tyr Ile Val Asn Ala Ser Gly
 305 310 315 320
 Asp Asp Phe Tyr Val Pro Asp Asn Ser Ser Phe Tyr Tyr Asp Asp Leu
 325 330 335
 Pro Gly Glu Lys Ala Leu Arg Phe Ala Pro Asn Ser Asn His His Gly
 340 345 350
 Ile Leu Asn Phe Thr Lys Gln Ser Leu Ile Pro Phe Val Asn Arg Val
 355 360 365
 Gln Lys Gly Ile Ser Thr Pro Val Leu Asp Ile Ser Thr Glu Met Thr
 370 375 380
 Glu Arg Val Gln Tyr Val Thr Val Arg Phe Ser Glu Val Pro Glu Lys
 385 390 395 400
 Ile Val Leu Trp Lys Ala Ala Asn Pro Glu Ser Arg Asp Phe Arg Tyr
 405 410 415
 Ala Cys Arg Val Arg Tyr Met Glu Thr Pro Leu His Leu Ser Ala Thr
 420 425 430
 Gly Glu Val Ser Val Ser Leu Glu Ile Pro Ser Val Gly Trp Gln Ala
 435 440 445
 Ala Phe Ile Glu Ala Thr Phe Lys Asp Gly Phe Val Ala Thr Thr Pro
 450 455 460
 Val Tyr Ile Leu Pro Lys Asp Ile Tyr Pro Pro Ile Lys Ile Pro Pro
 465 470 475 480
 Val His Gly Leu Leu Cys Lys Phe Val His Gly Arg Thr
 485 490

<210> 9
 <211> 2096
 <212> DNA
 <213> Lawsonia intracellularis

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<220>
<221> CDS
<222> (12)..(2096)

<400> 9
aggacaaaac t atg gcg gat tat ctt tca gga gga att tct ttt gga gga      50
          Met Ala Asp Tyr Leu Ser Gly Gly Ile Ser Phe Gly Gly
          1              5              10

att ggt agt gga acc gat ttc caa gct atg att gat caa ctt aag aaa      98
Ile Gly Ser Gly Thr Asp Phe Gln Ala Met Ile Asp Gln Leu Lys Lys
 15              20              25

att gag ctt att cct aaa aat aga ctt gta gtt tcc cat gaa caa tgg      146
Ile Glu Leu Ile Pro Lys Asn Arg Leu Val Ser His Glu Gln Trp
30              35              40              45

aca aaa aaa tat aaa gca ttt gaa gag ctt ata aaa aca gtt aaa gat      194
Thr Lys Lys Tyr Lys Ala Phe Glu Glu Leu Ile Lys Thr Val Lys Asp
          50              55              60

act gaa gcg tct tta agt aag cta agt tct gtt ggt gct att tta aaa      242
Thr Glu Ala Ser Leu Ser Lys Leu Ser Ser Val Gly Ala Ile Leu Lys
          65              70              75

aaa gaa ggt tct gtt tca aat act tct gtt gca agc gtt aag gca agt      290
Lys Glu Gly Ser Val Ser Asn Thr Ser Val Ala Ser Val Lys Ala Ser
          80              85              90

tct gat gca tct gat gga aca cat aca att gat gtg aaa cag ctt gca      338
Ser Asp Ala Ser Asp Gly Thr His Thr Ile Asp Val Lys Gln Leu Ala
          95              100              105

aca aac acg att ctt tct aat aat cat att ttt gat tct aaa act gaa      386
Thr Asn Thr Ile Leu Ser Asn Asn His Ile Phe Asp Ser Lys Thr Glu
110              115              120              125

agt att aat aat aca ggt tca cct ggt atc ttt gct tat gag tat aaa      434
Ser Ile Asn Asn Thr Gly Ser Pro Gly Ile Phe Ala Tyr Glu Tyr Lys
          130              135              140

ggg gaa cta cat gaa gtt gaa gtt cct cca ggt agt gat ctt gaa tat      482
Gly Glu Leu His Glu Val Glu Val Pro Pro Gly Ser Asp Leu Glu Tyr
          145              150              155

ctt gca aca tta ata aac aaa gat tct aat aat cct ggt gtt aaa gca      530
Leu Ala Thr Leu Ile Asn Lys Asp Ser Asn Asn Pro Gly Val Lys Ala
          160              165              170

aac ctt atc aag act ggc gat ggc tat atg ttt agt ctt gaa gga act      578
Asn Leu Ile Lys Thr Gly Asp Gly Tyr Met Phe Ser Leu Glu Gly Thr
          175              180              185

gaa act ggt gca aat gcg act tta tct att tca aat aag aca acg ctt      626
Glu Thr Gly Ala Asn Ala Thr Leu Ser Ile Ser Asn Lys Thr Thr Leu
190              195              200              205

cca gac ttt aaa gca tct gtt gct acc agc agt gca tta gct aat ggt      674
Pro Asp Phe Lys Ala Ser Val Ala Thr Ser Ser Ala Leu Ala Asn Gly
          210              215              220

gaa gat aca att att aat act tca gga aca act caa caa ttt tct ttt      722
Glu Asp Thr Ile Ile Asn Thr Ser Gly Thr Thr Gln Gln Phe Ser Phe

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	225		230		235	
	gaa tac aat gga aga aca ttt act ttc gat att cct tca gga aca aca					770
	Glu Tyr Asn Gly Arg Thr Phe Thr Phe Asp Ile Pro Ser Gly Thr Thr					
	240		245		250	
	gca aaa gaa ctc caa aca gct ata aat gaa aat aca aaa aat aca gga					818
	Ala Lys Glu Leu Gln Thr Ala Ile Asn Glu Asn Thr Lys Asn Thr Gly					
	255		260		265	
	gta cgt gca act ttt gaa aaa cat ggc tca gat ata gta ttg caa tta					866
	Val Arg Ala Thr Phe Glu Lys His Gly Ser Asp Ile Val Leu Gln Leu					
	270		275		280	285
	gaa gga aca gtt cct aat caa caa gtt aaa gta acc gct agc cct act					914
	Glu Gly Thr Val Pro Asn Gln Gln Val Lys Val Thr Ala Ser Pro Thr					
		290		295		300
	gat ctt gga agt ttc aca tct tcg ggt caa gca ggc tgg aat aaa cgt					962
	Asp Leu Gly Ser Phe Thr Ser Ser Gly Gln Ala Gly Trp Asn Lys Arg					
		305		310		315
	gat tct caa gat gct att ttt aat att aat ggt tgg gac caa gaa ctt					1010
	Asp Ser Gln Asp Ala Ile Phe Asn Ile Asn Gly Trp Asp Gln Glu Leu					
		320		325		330
	aca tct tct aca aat gaa ctt aca gaa gtt atc cca gga ctt caa att					1058
	Thr Ser Ser Thr Asn Glu Leu Thr Glu Val Ile Pro Gly Leu Gln Ile					
		335		340		345
	aca cta ctt tcc gaa ggg aaa aca caa att aca att cag act tct act					1106
	Thr Leu Leu Ser Glu Gly Lys Thr Gln Ile Thr Ile Gln Thr Ser Thr					
	350		355		360	365
	gac gaa gta aaa aaa caa gtt gag aaa gca gta gag tct ata aat aat					1154
	Asp Glu Val Lys Lys Gln Val Glu Lys Ala Val Glu Ser Ile Asn Asn					
		370		375		380
	gtt ctt tcc aaa att caa gag tta act aaa gca aca gct gaa gac aaa					1202
	Val Leu Ser Lys Ile Gln Glu Leu Thr Lys Ala Thr Ala Glu Asp Lys					
		385		390		395
	gat gat agt aaa gac act tct agt tct tca agt aaa att cca tca tat					1250
	Asp Asp Ser Lys Asp Thr Ser Ser Ser Ser Ser Lys Ile Pro Ser Tyr					
		400		405		410
	tta caa agt cct aca aaa gtg aag gct gga cta ttt aca ggt gat act					1298
	Leu Gln Ser Pro Thr Lys Val Lys Ala Gly Leu Phe Thr Gly Asp Thr					
		415		420		425
	ggc ata caa atg ctt agt act aga ctt aag tct atc ttt tct tct aat					1346
	Gly Ile Gln Met Leu Ser Thr Arg Leu Lys Ser Ile Phe Ser Ser Asn					
	430		435		440	445
	ggg cta ggt ttt tct cct aaa caa aca caa gat ggt cca ggg gat cta					1394
	Gly Leu Gly Phe Ser Pro Lys Gln Thr Gln Asp Gly Pro Gly Asp Leu					
		450		455		460
	ttt tca tca ctt gct tca att ggt att gtc gta gat gct gat gag ggt					1442
	Phe Ser Ser Leu Ala Ser Ile Gly Ile Val Val Asp Ala Asp Glu Gly					
		465		470		475
	agt gaa act ttt gga caa ctt aaa att tta gat aga gaa aca att ggt					1490
	Ser Glu Thr Phe Gly Gln Leu Lys Ile Leu Asp Arg Glu Thr Ile Gly					
		480		485		490

cct gat gca cct tat aca act ctt gat gag gca tta aaa aaa gat cca 1538
 Pro Asp Ala Pro Tyr Thr Thr Leu Asp Glu Ala Leu Lys Lys Asp Pro
 495 500 505

caa gca gta gca gat ata tta gct ggt agt tct gga ata tct gat tca 1586
 Gln Ala Val Ala Asp Ile Leu Ala Gly Ser Ser Gly Ile Ser Asp Ser
 510 515 520 525

aca gat ttt tct tat caa gat cat att gtt gga aaa aca caa gct ggt 1634
 Thr Asp Phe Ser Tyr Gln Asp His Ile Val Gly Lys Thr Gln Ala Gly
 530 535 540

aca tat gat gta aag tat tct gta gat gca agt ggt act ata gga gac 1682
 Thr Tyr Asp Val Lys Tyr Ser Val Asp Ala Ser Gly Thr Ile Gly Asp
 545 550 555

gtt tac att gga ggt gta aaa gct tct cta tct gat cct gca aaa aat 1730
 Val Tyr Ile Gly Gly Val Lys Ala Ser Leu Ser Asp Pro Ala Lys Asn
 560 565 570

ata tat acg gtc aca tct ggt cct gct aca ggt ctt agt ata gca gtt 1778
 Ile Tyr Thr Val Thr Ser Gly Pro Ala Thr Gly Leu Ser Ile Ala Val
 575 580 585

aat aat cgt act cca ggt atc aat gta gaa agt act gta aga gtc aaa 1826
 Asn Asn Arg Thr Pro Gly Ile Asn Val Glu Ser Thr Val Arg Val Lys
 590 595 600 605

caa ggt aaa ctt agc caa ata caa gaa gca ctt aaa gct gaa gta cag 1874
 Gln Gly Lys Leu Ser Gln Ile Gln Glu Ala Leu Lys Ala Glu Val Gln
 610 615 620

caa gat cct tta aaa gaa aac aca ggt cct tta att atc atg caa gat 1922
 Gln Asp Pro Leu Lys Glu Asn Thr Gly Pro Leu Ile Ile Met Gln Asp
 625 630 635

aac tat aag gat gtt atg aaa aat ctt gag aca aga ata gaa aaa gaa 1970
 Asn Tyr Lys Asp Val Met Lys Asn Leu Glu Thr Arg Ile Glu Lys Glu
 640 645 650

aca caa aga gtt act agt tgg gaa cgt atg atg cgt tta aaa ttt tct 2018
 Thr Gln Arg Val Thr Ser Trp Glu Arg Met Met Arg Leu Lys Phe Ser
 655 660 665

aga ctt gat gct gta tta gca aaa tat aat cag atg atg tca gca aat 2066
 Arg Leu Asp Ala Val Leu Ala Lys Tyr Asn Gln Met Met Ser Ala Asn
 670 675 680 685

gct tct agt tta ggg caa ctt ggt gca taa 2096
 Ala Ser Ser Leu Gly Gln Leu Gly Ala
 690

<210> 10
 <211> 694
 <212> PRT
 <213> Lawsonia intracellularis
 <400> 10

Met Ala Asp Tyr Leu Ser Gly Gly Ile Ser Phe Gly Gly Ile Gly Ser
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Gly Thr Asp Phe Gln Ala Met Ile Asp Gln Leu Lys Lys Ile Glu Leu
 20 25 30

Ile Pro Lys Asn Arg Leu Val Val Ser His Glu Gln Trp Thr Lys Lys
 35 40 45

Tyr Lys Ala Phe Glu Glu Leu Ile Lys Thr Val Lys Asp Thr Glu Ala
 50 55 60

Ser Leu Ser Lys Leu Ser Ser Val Gly Ala Ile Leu Lys Lys Glu Gly
 65 70 75 80

Ser Val Ser Asn Thr Ser Val Ala Ser Val Lys Ala Ser Ser Asp Ala
 85 90 95

Ser Asp Gly Thr His Thr Ile Asp Val Lys Gln Leu Ala Thr Asn Thr
 100 105 110

Ile Leu Ser Asn Asn His Ile Phe Asp Ser Lys Thr Glu Ser Ile Asn
 115 120 125

Asn Thr Gly Ser Pro Gly Ile Phe Ala Tyr Glu Tyr Lys Gly Glu Leu
 130 135 140

His Glu Val Glu Val Pro Pro Gly Ser Asp Leu Glu Tyr Leu Ala Thr
 145 150 155 160

Leu Ile Asn Lys Asp Ser Asn Asn Pro Gly Val Lys Ala Asn Leu Ile
 165 170 175

Lys Thr Gly Asp Gly Tyr Met Phe Ser Leu Glu Gly Thr Glu Thr Gly
 180 185 190

Ala Asn Ala Thr Leu Ser Ile Ser Asn Lys Thr Thr Leu Pro Asp Phe
 195 200 205

Lys Ala Ser Val Ala Thr Ser Ser Ala Leu Ala Asn Gly Glu Asp Thr
 210 215 220

Ile Ile Asn Thr Ser Gly Thr Thr Gln Gln Phe Ser Phe Glu Tyr Asn
 225 230 235 240

Gly Arg Thr Phe Thr Phe Asp Ile Pro Ser Gly Thr Thr Ala Lys Glu
 245 250 255

Leu Gln Thr Ala Ile Asn Glu Asn Thr Lys Asn Thr Gly Val Arg Ala
 260 265 270

Thr Phe Glu Lys His Gly Ser Asp Ile Val Leu Gln Leu Glu Gly Thr

275		280		285
Val Pro Asn Gln Gln Val	Lys Val Thr Ala Ser	Pro Thr Asp Leu Gly		
290	295	300		
Ser Phe Thr Ser Ser Gly	Gln Ala Gly Trp Asn Lys Arg Asp Ser Gln			
305	310	315		320
Asp Ala Ile Phe Asn Ile	Asn Gly Trp Asp Gln Glu Leu Thr Ser Ser			
	325	330		335
Thr Asn Glu Leu Thr Glu Val	Ile Pro Gly Leu Gln Ile Thr Leu Leu			
	340	345		350
Ser Glu Gly Lys Thr Gln Ile	Thr Ile Gln Thr Ser Thr Asp Glu Val			
	355	360		365
Lys Lys Gln Val Glu Lys	Ala Val Glu Ser Ile Asn Asn Val Leu Ser			
	370	375		380
Lys Ile Gln Glu Leu Thr	Lys Ala Thr Ala Glu Asp Lys Asp Asp Ser			
385	390	395		400
Lys Asp Thr Ser Ser Ser	Ser Ser Lys Ile Pro Ser Tyr Leu Gln Ser			
	405	410		415
Pro Thr Lys Val Lys Ala Gly	Leu Phe Thr Gly Asp Thr Gly Ile Gln			
	420	425		430
Met Leu Ser Thr Arg Leu Lys	Ser Ile Phe Ser Ser Asn Gly Leu Gly			
	435	440		445
Phe Ser Pro Lys Gln Thr	Gln Asp Gly Pro Gly Asp Leu Phe Ser Ser			
	450	455		460
Leu Ala Ser Ile Gly Ile Val Val	Asp Ala Asp Glu Gly Ser Glu Thr			
465	470	475		480
Phe Gly Gln Leu Lys Ile Leu	Asp Arg Glu Thr Ile Gly Pro Asp Ala			
	485	490		495
Pro Tyr Thr Thr Leu Asp Glu	Ala Leu Lys Lys Asp Pro Gln Ala Val			
	500	505		510
Ala Asp Ile Leu Ala Gly Ser	Ser Gly Ile Ser Asp Ser Thr Asp Phe			
	515	520		525
Ser Tyr Gln Asp His Ile Val	Gly Lys Thr Gln Ala Gly Thr Tyr Asp			
	530	535		540

Val Lys Tyr Ser Val Asp Ala Ser Gly Thr Ile Gly Asp Val Tyr Ile
545 550 555 560

Gly Gly Val Lys Ala Ser Leu Ser Asp Pro Ala Lys Asn Ile Tyr Thr
565 570 575

Val Thr Ser Gly Pro Ala Thr Gly Leu Ser Ile Ala Val Asn Asn Arg
580 585 590

Thr Pro Gly Ile Asn Val Glu Ser Thr Val Arg Val Lys Gln Gly Lys
595 600 605

Leu Ser Gln Ile Gln Glu Ala Leu Lys Ala Glu Val Gln Gln Asp Pro
610 615 620

Leu Lys Glu Asn Thr Gly Pro Leu Ile Ile Met Gln Asp Asn Tyr Lys
625 630 635 640

Asp Val Met Lys Asn Leu Glu Thr Arg Ile Glu Lys Glu Thr Gln Arg
645 650 655

Val Thr Ser Trp Glu Arg Met Met Arg Leu Lys Phe Ser Arg Leu Asp
660 665 670

Ala Val Leu Ala Lys Tyr Asn Gln Met Met Ser Ala Asn Ala Ser Ser
675 680 685

Leu Gly Gln Leu Gly Ala
690

<210> 11
<211> 1200
<212> DNA
<213> Lawsonia intracellularis

<220>
<221> CDS
<222> (13)..(1200)

<400> 11
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Met Ala Asn Val Ser Gly Ile Pro Ala Pro Arg Leu Leu
1 5 10
tcc aca aca aat caa atg acc aat gca gct gct ggt aat act aat aga 99
Ser Thr Thr Asn Gln Met Thr Asn Ala Ala Ala Gly Asn Thr Asn Arg
15 20 25
gct acc ggt agt atg aac ggt cgt aat ctc aca caa ata aaa aca cct 147
Ala Thr Gly Ser Met Asn Gly Arg Asn Leu Thr Gln Ile Lys Thr Pro
30 35 40 45

cag tcc atg att gat aat gct tca gaa gaa tta aca act tct ctt gaa Gln Ser Met Ile Asp Asn Ala Ser Glu Glu Leu Thr Thr Ser Leu Glu 50 55 60	195
tct aaa agc agt gac gac ttt gca att aaa gat cgt aaa aga caa ggg Ser Lys Ser Ser Asp Asp Phe Ala Ile Lys Asp Arg Lys Arg Gln Gly 65 70 75	243
aaa gga tct gat tct cta tta aaa atg gtt caa gaa tat aca gag ctg Lys Gly Ser Asp Ser Leu Leu Lys Met Val Gln Glu Tyr Thr Glu Leu 80 85 90	291
acg aat gat gat acc cgt aat gct aaa aga gct atg tta tcc cag gta Thr Asn Asp Asp Thr Arg Asn Ala Lys Arg Ala Met Leu Ser Gln Val 95 100 105	339
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Ile Ala Leu Lys Asn Glu Asn Phe Ile Ser Pro Ser Ser Ile Asp Lys
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 Ile Asp Asn Ala Ser Glu Glu Leu Thr Thr Ser Leu Glu Ser Lys Ser
 50 55 60
 Ser Asp Asp Phe Ala Ile Lys Asp Arg Lys Arg Gln Gly Lys Gly Ser
 65 70 75 80
 Asp Ser Leu Leu Lys Met Val Gln Glu Tyr Thr Glu Leu Thr Asn Asp
 85 90 95
 Asp Thr Arg Asn Ala Lys Arg Ala Met Leu Ser Gln Val Leu Arg Ala
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 Ser Gln Ser Ser Gln Asp Val Leu Glu Lys Thr Leu Glu Gln Phe Ser
 115 120 125
 Asn Lys Thr Asp Ala Trp Ala Ser Leu Ala Glu Ile Ala Gln Glu Tyr
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Gly Ala Glu Ser Pro Gln Pro Thr Gly Leu Lys Ser Val Leu Asp Ala
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Lys Gly Ala Leu Asn Ser Lys Glu Phe Thr Asp Ile Gly Ser Ala Ala
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Gln Leu Arg Asp Leu Tyr Thr Thr Thr Val Thr Ile Thr Ala Ala Pro
 195 200 205

Asp Ala Val Leu Ala Arg Leu Leu Glu Glu Tyr Glu Ser Asp Asp Asp
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Leu Asp Arg Ala Ile Asp Phe Leu Leu Ser Thr Leu Gly Gly Glu Leu
 225 230 235 240

Glu Ser Ala Asp Pro Ser Met Asp Lys Val His Leu Gln Ser Val Met
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Gly Asp Ile Glu Lys Thr Gln Gln Leu His Ser Ser His Lys Gln Cys
 260 265 270

Thr Thr Ala Leu Ser Arg Trp Lys Glu Lys His Lys Gly Gly Gly Glu
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Asn Ser Thr Leu Thr Pro Leu Glu Met Met Arg Glu Leu Ile Ala Leu
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 305 310 315 320

Gln Ala Asp Pro Gln Asp Ile Glu Lys Glu Val Leu Phe Leu Gln Glu
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Met Leu Ala Ala Val Arg Lys Phe Pro Ile Met Val Phe Asp Asn Val
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Glu Asn Arg Val Arg Val Met Gly Ala Val Gln Asp Ala Val Asp Asp
 355 360 365

Ala Val Arg Arg Glu Asp Glu Phe Leu Phe Gln Lys Glu His Pro Asp
 370 375 380

Val Pro Leu Gln Pro Asp Glu Asn Asn Ile Gln
 385 390 395

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Val Ala Ser Ile Asp Ala Ala Met Ser Ser Leu Ser Asp Gly Lys Val	
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Ser Ile Ser Ala Gly Ile Ser Lys Ala Leu Glu Ala Met Gly Val Pro	
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Ala Glu Thr Ala Gln Trp Ile Ala Phe Gly Ile Gln Leu Ala Met Ile	
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Ala Val Thr Ile Ala Ile Gly Phe Ala Ser Gly Gly Gly Gly Ala Met	
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Ala Gly Val Ser Lys Ile Ala Asp Met Phe Ser Lys Ser Gln Asp Val	
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315 320 325	
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Gln Asn Lys Glu Gln Gln Val Lys Phe Gln Glu Gln Ile Lys Lys Ile
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 180 185 190

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 195 200 205

Ala Ala Gly Ile Met Ala Ile Val Ala Ser Ile Asp Ala Ala Met Ser
 210 215 220

Ser Leu Ser Asp Gly Lys Val Ser Ile Ser Ala Gly Ile Ser Lys Ala
 225 230 235 240

Leu Glu Ala Met Gly Val Pro Ala Glu Thr Ala Gln Trp Ile Ala Phe
 245 250 255

Gly Ile Gln Leu Ala Met Ile Ala Val Thr Ile Ala Ile Gly Phe Ala
 260 265 270

Ser Gly Gly Gly Gly Ala Met Ala Gly Val Ser Lys Ile Ala Asp Met

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Gly Gly Thr Gly Ile Gly Thr Ala Val Val Gln Ser Asn Ile Lys Ala			
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Asn Glu Ser Glu Gln Lys Glu Ile Glu Ala Ala Ile Ala Lys Val Lys			
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Ala Lys Ile Glu Thr Leu Gln Asp Phe Phe Lys Asn Gln Met Glu Gln			
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Ala Gln Arg Asn Leu Ser Lys Ser Tyr Gly Glu Leu Ser Ser Ser Val			
15 20 25			
cga aaa ctt tct tca ggt ctt cgt gta gga act gct gct gat gac tca			147
Arg Lys Leu Ser Ser Gly Leu Arg Val Gly Thr Ala Ala Asp Asp Ser			
30 35 40 45			
gca ggg tta gcc att cga gaa ctc atg aga tct gac att gca aca aca			195
Ala Gly Leu Ala Ile Arg Glu Leu Met Arg Ser Asp Ile Ala Thr Thr			
50 55 60			
caa caa gga ata cga aat gcg aat gat gct att tct atg att caa act			243
Gln Gln Gly Ile Arg Asn Ala Asn Asp Ala Ile Ser Met Ile Gln Thr			
65 70 75			
gcg gat ggt gca ctt gga gtc atc gat gaa aag ctc att cga atg aaa			291
Ala Asp Gly Ala Leu Gly Val Ile Asp Glu Lys Leu Ile Arg Met Lys			
80 85 90			

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atg att att gac tct gaa tat caa gct atg gcc tca gaa att act cgt      387
Met Ile Ile Asp Ser Glu Tyr Gln Ala Met Ala Ser Glu Ile Thr Arg
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Ile Ala Asn Ala Thr Glu Phe Asn Gly Ile Lys Leu Leu Asp Gly Ser
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tta tca ggt aat cat gat ggg aaa aaa ata aat tca act ggt gca gta      483
Leu Ser Gly Asn His Asp Gly Lys Lys Ile Asn Ser Thr Gly Ala Val
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cgt atc cac ttt ggg aca tct aac agc tct gct gaa gat tac tat gat      531
Arg Ile His Phe Gly Thr Ser Asn Ser Ser Ala Glu Asp Tyr Tyr Asp
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Ile Lys Ile Gly Gly Ser Thr Ala Ser Ala Leu Gly Leu Gly Asn Thr
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gta aaa ggt gcg ggt gct aca gtc tct act caa gct gca gca caa aat      627
Val Lys Gly Ala Gly Ala Thr Val Ser Thr Gln Ala Ala Ala Gln Asn
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Ala Leu Lys Ala Ile Asp Asn Ala Ile Val Ser Lys Asp Lys Ile Arg
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Leu Ser Ile Gln Asn Glu Asn Leu Gln Ala Ala Glu Ser Arg Ile Ser
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gat ata gat gta agc caa gaa atg aca caa ttt gta cgt aac caa ata      819
Asp Ile Asp Val Ser Gln Glu Met Thr Gln Phe Val Arg Asn Gln Ile
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ctt aca caa aca ggt gtt gct atg ctt tca caa gct aat tct cta cca      867
Leu Thr Gln Thr Gly Val Ala Met Leu Ser Gln Ala Asn Ser Leu Pro
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Ser Ser Gly Leu Arg Val Gly Thr Ala Ala Asp Asp Ser Ala Gly Leu
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Ala Ile Arg Glu Leu Met Arg Ser Asp Ile Ala Thr Thr Gln Gln Gly
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Ile Arg Asn Ala Asn Asp Ala Ile Ser Met Ile Gln Thr Ala Asp Gly
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Ala Leu Gly Val Ile Asp Glu Lys Leu Ile Arg Met Lys Glu Leu Ala
 85 90 95

Glu Gln Ala Ala Thr Gly Thr Tyr Asn Ser Thr Gln Arg Met Ile Ile
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Asp Ser Glu Tyr Gln Ala Met Ala Ser Glu Ile Thr Arg Ile Ala Asn
 115 120 125

Ala Thr Glu Phe Asn Gly Ile Lys Leu Leu Asp Gly Ser Leu Ser Gly
 130 135 140

Asn His Asp Gly Lys Lys Ile Asn Ser Thr Gly Ala Val Arg Ile His
 145 150 155 160

Phe Gly Thr Ser Asn Ser Ser Ala Glu Asp Tyr Tyr Asp Ile Lys Ile
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Gly Gly Ser Thr Ala Ser Ala Leu Gly Leu Gly Asn Thr Val Lys Gly
 180 185 190

Ala Gly Ala Thr Val Ser Thr Gln Ala Ala Ala Gln Asn Ala Leu Lys
 195 200 205

Ala Ile Asp Asn Ala Ile Val Ser Lys Asp Lys Ile Arg Ala His Leu
 210 215 220

Gly Gly Leu Gln Asn Arg Leu Glu Ala Thr Val Asp Asn Leu Ser Ile
 225 230 235 240

Gln Asn Glu Asn Leu Gln Ala Ala Glu Ser Arg Ile Ser Asp Ile Asp
 245 250 255

Val Ser Gln Glu Met Thr Gln Phe Val Arg Asn Gln Ile Leu Thr Gln
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Thr Gly Val Ala Met Leu Ser Gln Ala Asn Ser Leu Pro Arg Met Ala


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Gln Ile Ile Lys Ile Leu Leu Phe Ser Leu Cys Val Phe Phe Phe Thr
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Leu Thr Glu Lys Gln Lys Ile Tyr Ala Ala Asp Val Phe Phe Glu Gly
25                               30                               35                               40

aga acc gaa acc tta atc aat gta aac aaa cca ttt gat tct ttt ttt      196
Arg Thr Glu Thr 45 Ile Asn Val Asn Lys Pro Phe Asp Ser Phe Phe
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gga ggt tct gac tct aca ata gga acc ctt gaa aca gga cct act aat      244
Gly Gly Ser Asp Ser Thr Ile Gly Thr Leu Glu Thr Gly Pro Thr Asn
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ctt acc ttc aca aca gta gga gcc ttc cgc aat tct gtt ttc aga att      292
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75                               80                               85

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Ile Gly Gly Gly Arg Ser Ser Phe Asn Asn Pro Asn Thr Val Lys Gly
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Ala Gly Ile Ser Asn Arg Gly Leu Val Thr Val Thr Gly Ser Val Asn
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tat act caa aat gga cat gta cta ggc tct atc aac atg cat ttg aaa      532
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155                               160                               165

aac gtc caa act cca cta tta ata ggt tct gga gta agc aat gga cct      580
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gag act act aac tgg cta aga caa caa cat ata tgg act cta caa aac Glu Thr Thr Asn Trp Leu Arg Gln Gln His Ile Trp Thr Leu Gln Asn 650 655 660	2020
cgt tca agt aaa ctt tta gac aac gaa cat tat gga cta tgg ata aat Arg Ser Ser Lys Leu Leu Asp Asn Glu His Tyr Gly Leu Trp Ile Asn 665 670 675 680	2068
gtt caa ggt gga cat gaa agt ctt gat act tct att ggt agc aaa gca Val Gln Gly Gly His Glu Ser Leu Asp Thr Ser Ile Gly Ser Lys Ala 685 690 695	2116
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Lys Met Pro Trp Ile Met Ala Thr Ala Gly Tyr Asp Tyr Leu Gln Gln	
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Leu Pro Arg Leu Asp Met Lys Ala Leu Tyr Gly Leu Ala Phe Gly Ala	
715 720 725	
tct aaa ggt aaa agt aaa tgg tct agc gtc aac tct aca aaa aat gat	2260
Ser Lys Gly Lys Ser Lys Trp Ser Ser Val Asn Ser Thr Lys Asn Asp	
730 735 740	
gct gag cta ggt atg gtt agt ggt tat gta ggt ctt atc cat aac aaa	2308
Ala Glu Leu Gly Met Val Ser Gly Tyr Val Gly Leu Ile His Asn Lys	
745 750 755 760	
act ggg ctc tat agt aca ttg acc tta caa ctt gcg tct agt aaa tta	2356
Thr Gly Leu Tyr Thr Leu Thr Leu Leu Ala Ser Ser Lys Leu	
765 770 775	
cat act aat tct aca ggg ttc tat aga aat ttt aaa tgg aca gaa aca	2404
His Thr Asn Ser Thr Gly Phe Tyr Arg Asn Phe Lys Trp Thr Glu Thr	
780 785 790	
act cca aca gaa gca ctt gaa ctt gga tgg aaa tac act ttc aac aac	2452
Thr Pro Thr Glu Ala Leu Glu Leu Gly Trp Lys Tyr Thr Phe Asn Asn	
795 800 805	
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Gly Ile Lys Met Asn Pro Arg Gly Gln Leu Ile Phe Glu Gln Thr Ser	
810 815 820	
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Lys His His Phe Asp Leu Gly Ile Gln Asn Asp Lys Ala Ile Leu Asp	
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Lys Ser Gln Leu Ile Thr Ser Ser Leu Gly Ile Thr Val Glu Tyr Lys	
845 850 855	
cta cca gtt acc aca cct att aat ctt tat gct ggt att gaa agg ata	2644
Leu Pro Val Thr Thr Pro Ile Asn Leu Tyr Ala Gly Ile Glu Arg Ile	
860 865 870	
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Lys Gly Gln Ser Gly Asn Phe Ala Ile Ser Ser Gln Ser Leu Gln Met	
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Lys Phe Lys His Asp Asn Asp Thr Ser Val Val Arg Ala Thr Ile Gly	
890 895 900	
aca aat ata tta ttg gga gaa cat ttt aat att cac tgt gat ata ttt	2788
Thr Asn Ile Leu Leu Gly Glu His Phe Asn Ile His Cys Asp Ile Phe	
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 20 25 30

Ala Ala Asp Val Phe Phe Glu Gly Arg Thr Glu Thr Leu Ile Asn Val
 35 40 45

Asn Lys Pro Phe Asp Ser Phe Phe Gly Gly Ser Asp Ser Thr Ile Gly
 50 55 60

Thr Leu Glu Thr Gly Pro Thr Asn Leu Thr Phe Thr Thr Val Gly Ala
 65 70 75 80

Phe Arg Asn Ser Val Phe Arg Ile Ile Gly Gly Gly Arg Ser Ser Phe
 85 90 95

Asn Asn Pro Asn Thr Val Lys Gly Asn Val Thr Leu Thr Val Tyr Asn
 100 105 110

Thr Asp Val Glu Arg Ile Ile Gly Ala Gly Ile Ser Asn Arg Gly Leu
 115 120 125

Val Thr Val Thr Gly Ser Val Asn Met Lys Leu Glu Asn Val Ser Val
 130 135 140

Thr Arg Gly Ile Tyr Gly Gly Val Tyr Thr Gln Asn Gly His Val Leu
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Gly Ser Ile Asn Met His Leu Lys Asn Val Gln Thr Pro Leu Leu Ile
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Gly Ser Gly Val Ser Asn Gly Pro Asn Arg Ile Thr Val Asn Gly Asp
 180 185 190

Ile Asn Ile Asp Val Glu Asp Ser Arg Ile Gln Tyr Val Asn Ile Thr
 195 200 205

Gly Glu Val Asp Ala Gly Ile Lys Gly Asn Ala Thr Leu Thr Val Lys
 210 215 220

Lys Ser Thr Val Glu Leu Ile Asn Ser Gly Arg Gly Asn Ile Leu Gly
 225 230 235 240

Asn Leu Lys Ile Ser Ile Ala Asp Ser Asn Ile Arg Gly Leu Ser Pro
 245 250 255

Val Asp Phe Gly Ser Ser Val Tyr Gly Asp Thr Ser Ile Asn Val Ile
 260 265 270

Asn Ser Gln Ile Asn Asp Ile Thr Leu Ile Pro Arg Ala Gly Gly Met
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Leu Val Gly Pro Val Thr Leu Asp Ile Thr Ser Ser Thr Ile Gln Asn
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Ile Gln Cys Gly Pro Val Ser Gln Asn Asn Gln Leu Asn Thr Leu Asn
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Val Thr Val Asn Thr Ser Asn Ile Thr Asn Leu Asn Leu Gly Ser Val
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Glu Gly His Thr Ile Ser Thr Thr Ala Thr Val Thr Asp Ser Asn Ile
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Thr Asn Leu Asn Val Gly Thr Phe Asn Gly Leu Gly Val Thr Glu Asn
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Ala Ser Val Ile Ile Asn Ser Gly Asn Ile Thr Asn Leu Asn Val Gly
 370 375 380

Thr Asn Val Ile Ala Ala Ala Thr Thr Ile Asn Ser Ser Ala Thr Ile
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His Asp Gly Leu Ile Ala Asn Leu Thr Leu Gly Ser Gln Gly Asn Gly
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Arg Thr Met Ile Ala Thr Ala Asn Val Asn Gly Gly Thr Ile Gly Leu
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Leu Thr Met Gly Ser Glu Asn Phe Ile Pro Gly Thr Arg Pro Ile Thr
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Glu Leu Ala Ile Leu Asn Met Ser Gly Gly Leu Ile Glu Arg Ile Ile
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Val Gly Asn Ala Asn Ser Ser Thr Ile Asn Phe Thr Pro Gly Lys Arg
 465 470 475 480

Ser Ile Val Lys Thr Ile Asn Gly Pro Glu Leu Pro Tyr Leu Val Asn
 485 490 495

Ile Gln Lys Gly Ala Met Thr Gln Trp Gly Thr Lys Asn Met Pro Phe
 500 505 510

Leu Leu Asp Thr Arg Asn Leu Ile Leu Ser Gly Thr Leu Ile Thr Ser
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Asn Ile Gln Leu Ala Asp Leu Ser Ile Thr Asn Leu Phe Val Ala Asn
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Gly Gly Thr Leu Val Pro Arg Lys Leu Ile Pro Gly Asn Gln Pro Val
 545 550 555 560

Ile Gln Phe Leu Gly Gly Pro Gln Ser Leu Leu Val Ile His Gln Pro
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Leu Lys Val Asn Leu Ser Leu Ser Pro Lys Leu Ile Gly Ser Ser Met
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Val Pro Leu Ala Phe Val Ser Gln Ser Phe Ser Ser Pro Asp Leu Phe
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Val Lys Gln Thr Arg Ser Gly Leu Ile Trp Ser Asp Leu Glu Phe Asp
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Pro Thr Thr Ser Ile Trp Tyr Val Asn Asn Ile Gln Ala Ser Gln Asp
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Phe Tyr Ser Phe Ser Ile Ala Arg Glu Thr Thr Asn Trp Leu Arg Gln
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Gln His Ile Trp Thr Leu Gln Asn Arg Ser Ser Lys Leu Leu Asp Asn
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Glu His Tyr Gly Leu Trp Ile Asn Val Gln Gly Gly His Glu Ser Leu
 675 680 685

Asp Thr Ser Ile Gly Ser Lys Ala Lys Met Pro Trp Ile Met Ala Thr
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Ala Gly Tyr Asp Tyr Leu Gln Gln Leu Pro Arg Leu Asp Met Lys Ala
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Leu Tyr Gly Leu Ala Phe Gly Ala Ser Lys Gly Lys Ser Lys Trp Ser
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Ser Val Asn Ser Thr Lys Asn Asp Ala Glu Leu Gly Met Val Ser Gly
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Tyr Val Gly Leu Ile His Asn Lys Thr Gly Leu Tyr Ser Thr Leu Thr

